



A.D. 1841 N^o 8813.

S P E C I F I C A T I O N

OF

NATHAN WADDINGTON.

STEAM BOILERS AND THEIR FURNACES.

L O N D O N :

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Steam Boilers and their Furnaces.

WADDINGTON'S SPECIFICATION

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, NATHAN WADDINGTON, of Hulme, in the County of Lancaster, Engineer, send greeting.

WHEREAS Her present most Excellent Majesty Queen Victoria, by Her Letters Patent under the Great Seal of Great Britain, bearing date at Westminster, the Twenty-sixth day of January, in the fourth year of Her reign, did, for Herself, Her heirs and successors, give and grant unto me, the said Nathan Waddington, Her especial licence, full power, sole privilege and authority, that I, the said Nathan Waddington, my exors, admors, and assigns, and such others as I, the said Nathan Waddington, my exors, admors, and assigns, should at any time agree with, and no others, from time to time and at all times during the term of years therein expressed, should and lawfully might make, use, exercise, and vend, within England and Wales, and the Town of Berwick upon Tweed, my Invention of "CERTAIN IMPROVEMENTS IN THE CONSTRUCTION OF STEAM BOILERS, AND FURNACES FOR HEATING THE SAME;" in which said Letters Patent is contained a proviso that I, the said Nathan Waddington, shall cause a particular description of the nature of my said Invention, and in what manner the same is to be performed, to be enrolled in Her Majesty's High Court of Chancery within six calendar months, next and immediately after the date of the said in part recited Letters Patent, as in and by the same, reference being thereunto had, will more fully and at large appear.

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NOW KNOW YE, that in compliance with the said proviso, I, the said Nathan Waddington, do hereby declare that the nature of the said Invention of certain improvements in the construction of steam boilers, and furnaces for heating the same, to consist in the construction of boilers and furnaces in such manner that they shall generate steam with a less quantity of coal, at the 5 same time diminishing the nuisance of smoke, and the boiler possessing great strength to resist the elastic energy of the confined steam, together with accessibility to all its interior parts for the purpose of being cleaned out when required, and the manner in which the same are to be performed and carried into effect, will be seen by reference to the annexed Drawings and 10 the following description.

The scale to which these Drawings is made is marked thereon, and the same character, letter, or figure of reference indicates the same part in the various views, plans, sections, and elevations there represented. I shall first describe my improvements in stationary steam boilers and furnaces for heating 15 the same. Fig. 1 represents a front view of a boiler and furnace of my improved construction; Fig. 2, a transverse section of the same taken at the middle of the furnace; and Fig. 3, a transverse section of the furnace taken at the imaginary line G, G, see Fig. 4. Fig. 4 is a plan of the furnace with the boiler removed. Fig. 5 is a sectional plan of the boiler taken at the 20 imaginary line H, H, see Fig. 6; it also exhibits a bird's eye view of the exterior brickwork of the furnace, and likewise of the flue to the point at which the boiler divides for the remaining length; part of the brickwork is removed that the flue Z may be seen as it proceeds to the chimney. Fig. 6 is a longitudinal sectional elevation taken through the centre of the boiler and 25 furnace; Fig. 7, a transverse section taken at the line I, I, Fig. 6. About half the length of the boiler A is made in the form of portions of circles which are described from the centres \times , and in order that this form may be maintained, the stay plates K are connected to them as seen in Fig. 2, and that they may be of adequate strength must exceed the thickness of the exterior of the 30 boiler by one fourth; spaces are left between each plate, as seen at Figures 5 and 6, to allow a free flow for the water and steam; at about the half distance of the two extremities of the boiler the stay plates terminate, and the two larger portions of circles are made to assume the form of two cylinders, which diverge and proceed in the direction seen at Figures 5 and 6. The supply 35 water is introduced by the feed pipe E at the lowest part of the cylinders, see Figs 5, 6, and 7. The upper surface of the water indicated by the blue line shews the boiler to be filled with water at the lower extremity, and the upper part to be occupied with water and steam in nearly equal proportions.

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By referring to the last-named Figures it will be seen that the cylinders are enclosed in a flue Z, which permits and causes the heated current from the furnace to pass around and between the cylinders, and the bridges or checks *u, u*, are built in the flue to cause the heated current to impinge against the cylinders.

5 By the boiler being thus arranged a great heating surface is obtained which quickly abstracts the heat from the current in the flue. The steam generated in the boiler is conveyed in any required direction by the pipe R. I shall now proceed to describe more fully my improvements in furnaces. Fig. 2 represents a cross section of a furnace and boiler, and Fig. 4, a plan of the same,
 10 to which my improvements are applied. In these Figures the red line indicates the upper surface of the fuel. B represents the furnace bars; C, the ash pit; and F, F, portions of the furnace through which air has no passage, and therefore they act as dead plates, on which the whole supply of coals to the furnace is supplied from above through the openings L, L; these openings
 15 I call the feeding mouths; they are closed by the fuel when the furnace is in full operation, and when not so closed, the doors M, M, are shut to accomplish the same purpose. These doors are shewn in section at Fig. 2, and their interior construction by Fig. 8. The raking and arranging the fuel on the furnace bars and lighting the furnace are performed at the door N in front, which is
 20 made to open by sliding downwards, and for this purpose is suspended from a lever and balanced by the counter weight O. This door is closed during the ordinary working of the furnace, and is opened to only a limited extent when the fuel is raked upon the bars, as seen at Fig. 1. The grate bars are lower or incline downwards as they approach the centre of the width of the furnace,
 25 as shewn at Figures 2, 3, 10, and 12, to facilitate the raking of the fuel from F to that part where the fuel is in the most active combustion. Supposing therefore the furnace to be in full operation, and the parts F, F, to be loaded with coal, a constant coking or roasting of such coal will proceed, thereby also liberating the gases, which will necessarily proceed in their passage
 30 towards the flue over the ignited and glowing furnace, and their perfect combustion will thereby be greatly facilitated. A modification of my improvements in boilers and furnaces is exhibited at Figures 9, 10 and 11, which represent a boiler provided with a steam chamber marked ∇ . This boiler, for convenience of description, may be said to consist of three parts, each of which
 35 would be cylinders were it not that the side of the one cylinder in contact with that of the next to it is flattened, see Fig. 10; they are rivetted together, and form one boiler, having apertures of communication through the flattened sides, as shewn in Fig. 11. The flattened cylinders are rivetted together for about half the length of the boiler, at which point they diverge, and are three

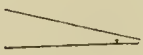
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or four inches asunder, assuming the form of perfect cylinders, their position in the flue being the same as that in Figures 5 and 6. There is an interval or space of from twenty to twenty four inches from the man-hole D to the nearest staying plates K, to allow a passage to each division of the boiler. The deviation in the interior of the furnace of this boiler from the one before 5 described is shewn in Fig. 10; there are two small doors *n, n*, shewn in Fig. 9, that may be used occasionally as auxiliary to the door N in the same Figure, the latter door is shewn open to the full extent to obtain the withdrawal of the clinkers from the furnace. It is constructed and opens similar to that of Fig. 1, already described. 10

Another modification is shewn at Fig. 12. Supposing the exterior of this boiler to be made of plates three eighths of an inch thickness, I have the plates K of half an inch thickness; spaces or openings of communication are left between the plates K, the same as shewn in the other boilers. Those portions of this boiler which form supporting sides for the fuel in the mouths 15 L, L, differ from the corresponding parts of those previously described, and in order that the strength of the boiler may be maintained at these parts a number of staying plates are connected at their two extremities to the portions of circles; the edge of one staying plate of each series of stays is represented by *j*; they are each five eighths of an inch thick, and seven inches broad, with 20 a space of three inches and a half between each for the flow of water. The projections which support the fuel terminate immediately beyond the feeding mouths, and the boiler then assumes the form of two portions of circles stayed by plates K, and continues of this form until the middle of its length is attained, when it divides and is formed into two cylinders, which are described 25 from shorter radii than those of the portions of cylinders. A longitudinal vertical section taken through the centre of one of the cylinders at the middle of the length of the boiler is shewn at Fig. 13. A man-hole is placed at the end of the boiler, and the nearest stay plate K is situated at such distance therefrom as will permit access to each part of the boiler. The boilers are 30 made of wrought iron plates, or other suitable material, and though I have described the preceding boilers to be constructed for about half their length (which I consider a good proportion) of metal plates formed into portions of circles and straight staying plates, and the remaining length of cylinders, yet this proportion is not absolutely requisite, and may be varied; and further, in 35 some cases, I make the entire length of the boiler to consist of circular parts and the staying plates K.

Having now described my improvements in steam boilers, and furnaces for heating the same, when they are stationary or fixed, I will proceed to describe

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my improvements in steam boilers and furnaces for heating the same when adapted to marine steam engines. Fig. 14 represents a front view of a marine boiler and furnace, with three furnace doors N, and two auxiliary ones marked *n*: the arrangement of fixing these doors, and the purpose they answer is the same as described in Figures 1 and 9. Fig. 15 is a transverse section of the boiler and furnace taken through the middle of the furnace, and exhibits two feeding mouths L, L, for to supply fuel on to the dead plates F, F. In this Figure the red line indicates the upper surface of the fuel; the blue line represents the water line. A, the boiler; B, the grate bars; and C, the ash pit. Fig. 16 is a longitudinal section of the boiler taken at the imaginary line S, S, of Fig. 15. Fig. 17 shows a longitudinal section of the boiler and furnace taken through the imaginary line Y, Y, at Fig. 18. Fig. 18 is a sectional plan at the blue water line at Fig. 15; and Fig. 19 a transverse section taken at the imaginary line T, T, at Fig. 17; the whole of the boiler is supported on a casing filled with water, as represented by the character \perp in Figures 14, 15, 17 and 19. The boiler and casing are rivetted or joined together, but there is no opening or aperture of communication between one and the other to prevent the generation of steam; the upper surface of the water casing is covered with bricks, but should any be formed it rises to the upper end, and passes through the escape pipe marked  into the chimney. The pipe which supplies water to the casing is indicated by the marked \perp . The space beyond the bridge that is inclosed between the boiler and the bricks which rest upon the casing constitutes the flue Z, which conveys the heated current from the furnace to the chimney P. If the boat be of iron the water case (which is only necessary for a wooden boat or ship to protect it from fire) may be dispensed with, and the bottom of the ash pit and flue be formed of bricks supported upon iron. On referring to Figures 17, 18, and 19 it will be seen that a series of cylinders V are attached to and form part of the boiler; they are closed at their lower extremities, but are open at the upper so as to allow free communication for the water contained in them with that which is above in the other part of the boiler. To enable these cylinders more rapidly and effectually to abstract the heat from the current in the flue they are placed in an alternate oblique direction, and intersect each other, as seen at Fig. 19. The plates marked W, see Figures 16, 17, and 18, act as partitions, and in conjunction with the plates K prevent the mass of water from running either to the end or side of the boiler by the pitching of the vessel. The portions of circles of the exterior of the boiler have \times , \times , for their centres. K, K, represent stay plates which prevent and oppose the

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elastic energy of the confined steam from bursting or deranging the boiler by forcing asunder the top from the bottom, and that they may be of adequate strength I make them to exceed by one fourth the thickness of the plates that compose the portions of circles to which they are connected; spaces or apertures of communication are left between the contiguous plates shewn in 5 the sectional elevation, Fig 17. These apertures extend to the top of the staying plates, but do not reach to where the stay plates at their lower end join the circular parts of the boiler. The section of the feeding mouths at Fig. 15 exhibits the stay plates *j*, which are the same in their arrangement as those at the feeding mouths at Fig. 12, already described, and the mode of 10 supplying the furnace with coal, and raking the fuel upon the bars after being roasted or coaked, is the same as that which has been described for stationary boilers. The bridge *Q* is shewn at Fig. 17 in section, and is composed of fire-bricks supported on the under side by an iron plate, one end of which is fixed to the water case, and the other end to the bearer which carries the grate 15 bars. My improvements in marine steam boilers, and furnaces for heating the same, are also applicable to steam boats used for inland navigation. In such application, the boilers and furnaces being much narrower than those required for sea-going vessels, the arrangement of one feeding mouth situated near the centre of the width of the furnace will in general be the most appropriate. 20

Having described my Invention, and the means of performing the same, I would have it understood that I do not confine myself to the precise detail shewn and described so long as the novel characters and peculiar features of my improvements be retained, and in order that the extent and limitation of my claim may be understood, I would observe that I do not claim generally 25 the cylindrical construction of steam boilers, or the coaking or roasting of fuel previous to its being submitted to active combustion, but I do claim the construction of the steam boilers when formed either for its entire length of a combination of circular parts and staying plates, or when only a portion of its length consists of the combination of circular parts and staying plates and 30 the remainder of cylinders, in either case accessible in all its parts by one man-hole, as already explained, and I claim for the cylinders which intersect each other in the flue when they are used in combination and form part of the steam boilers used for marine or inland navigation, as already explained. And as regards the furnaces for heating the same, I claim the combination 35 and arrangement of those parts on which the fuel is supported and submitted to the coaking or roasting action of the furnace, as already described. And finally, I claim the arrangement of the furnace doors and the grate bars when

FIG. 1.

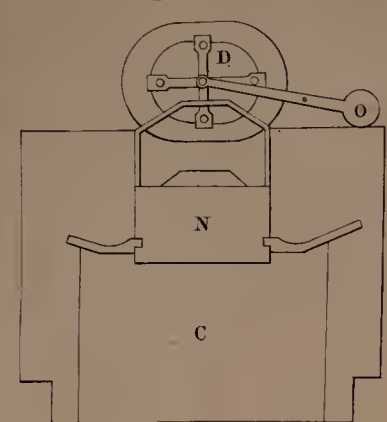


FIG. 3.

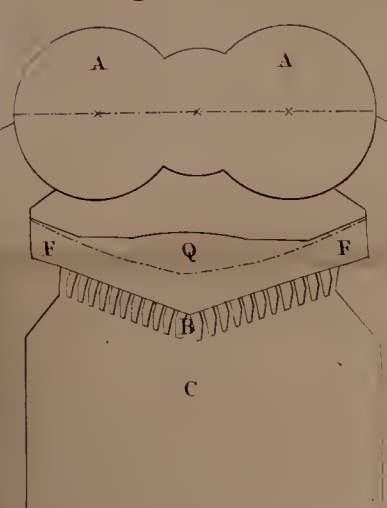


FIG. 2.

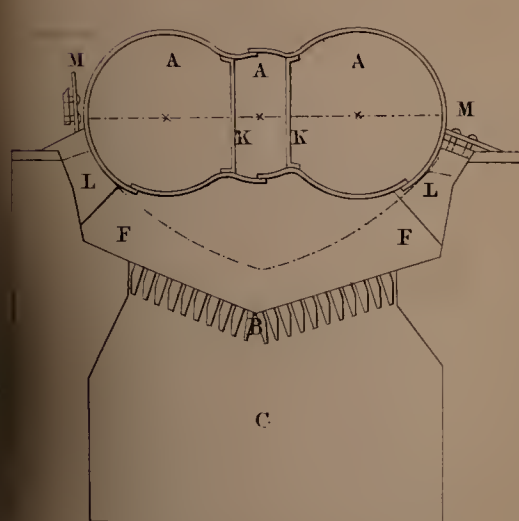


FIG. 4.

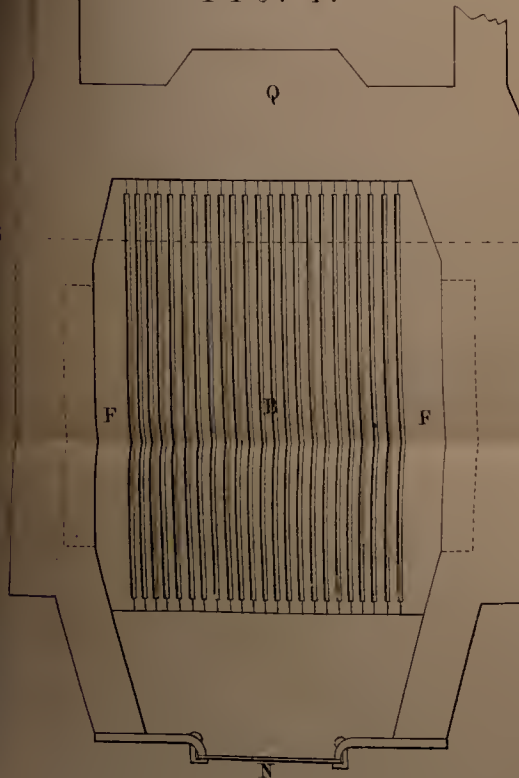


FIG. 10.

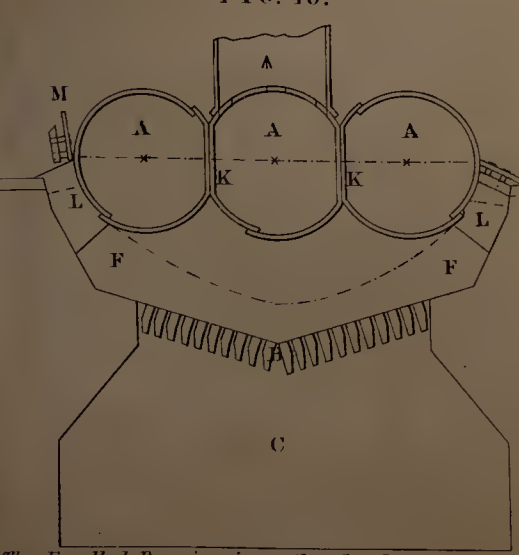


FIG. 7.

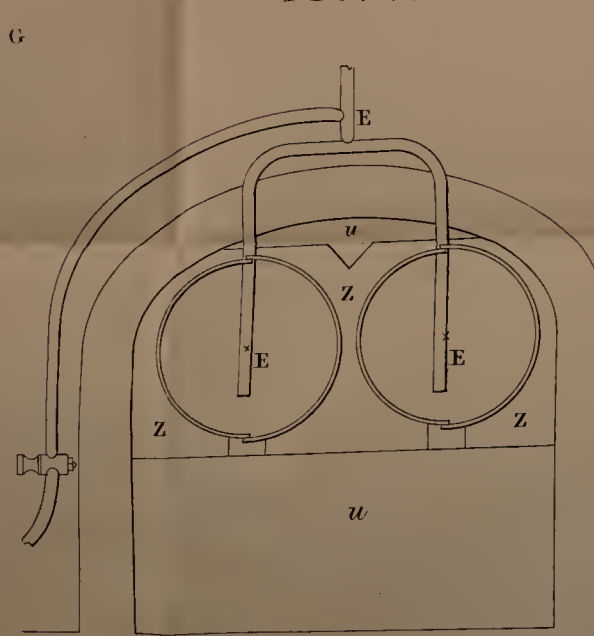
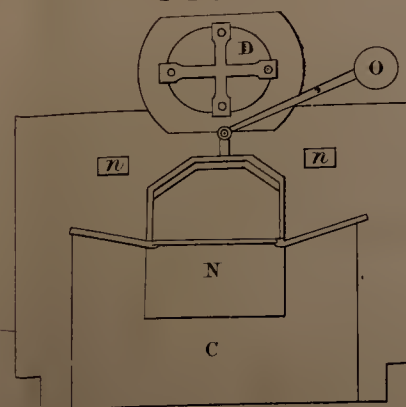


FIG. 9.



Scale half Inch = 1 Foot.

FIG. 5.

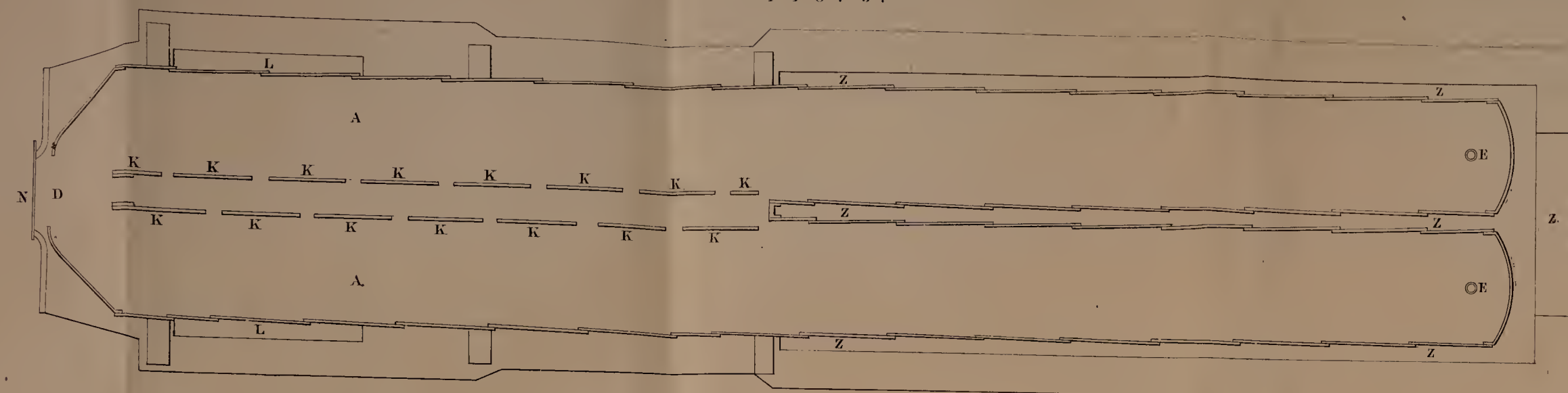


FIG. 6.

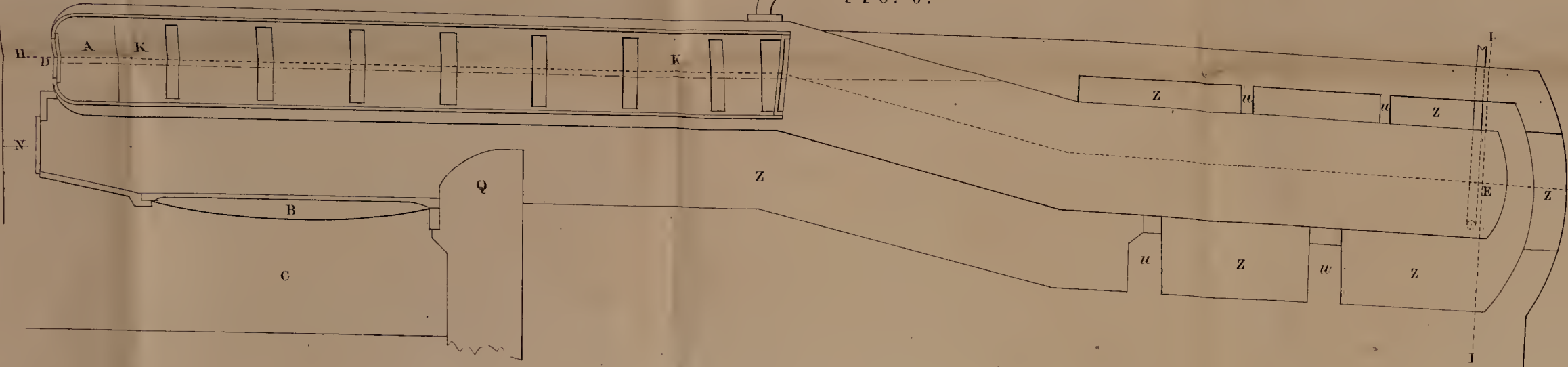


FIG. 11.

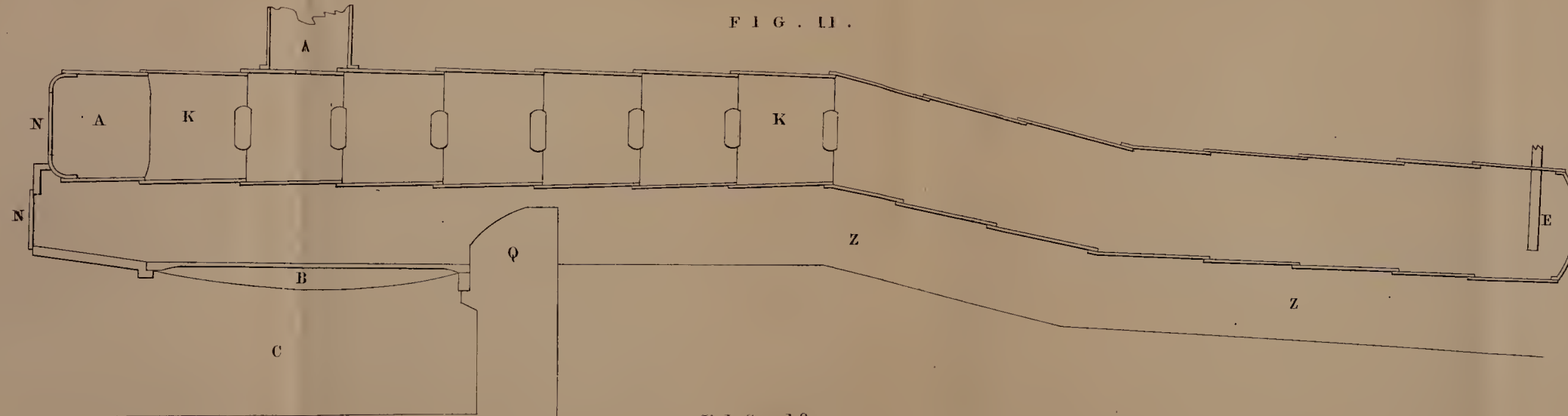


FIG. 18.

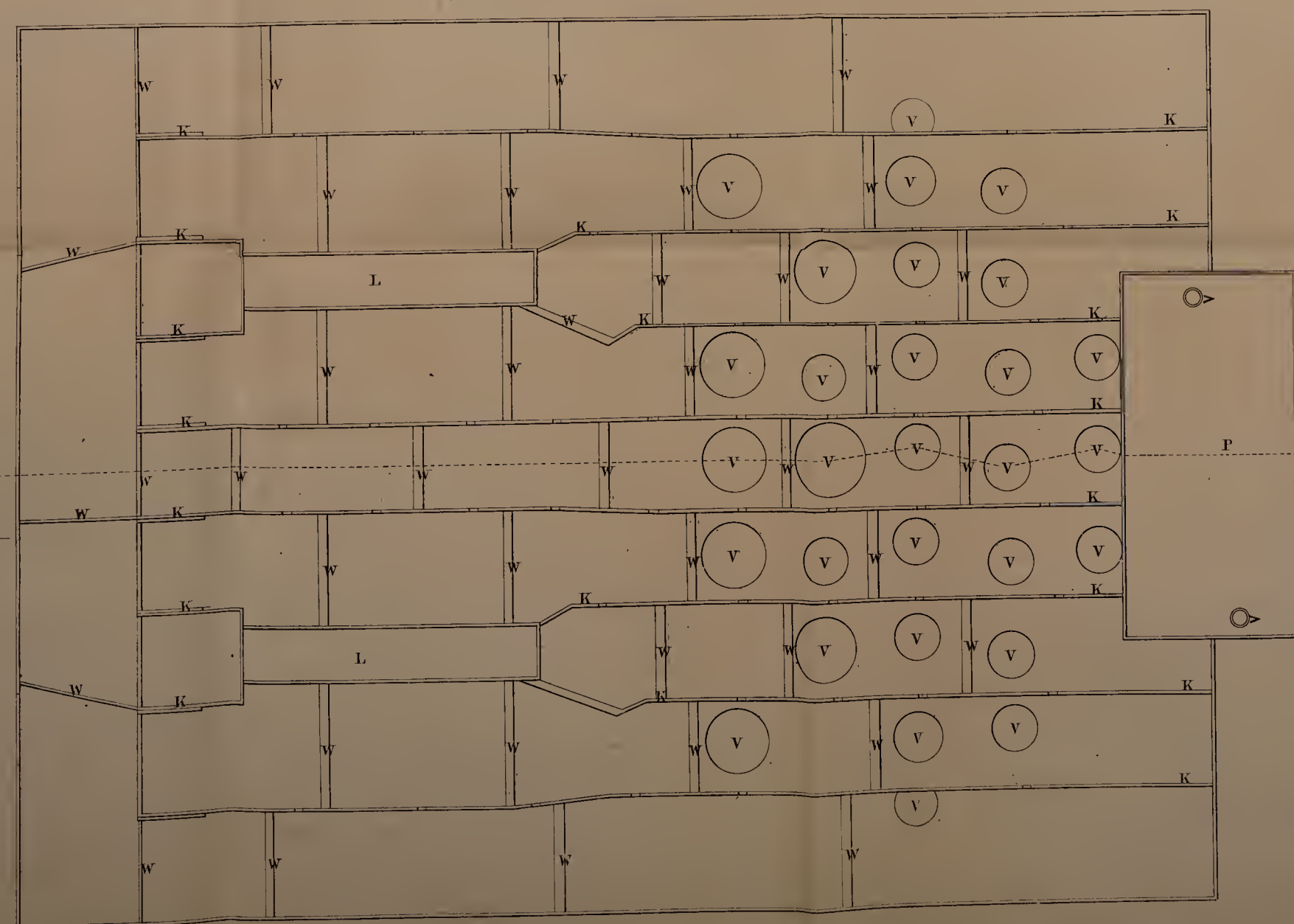


FIG. 19.

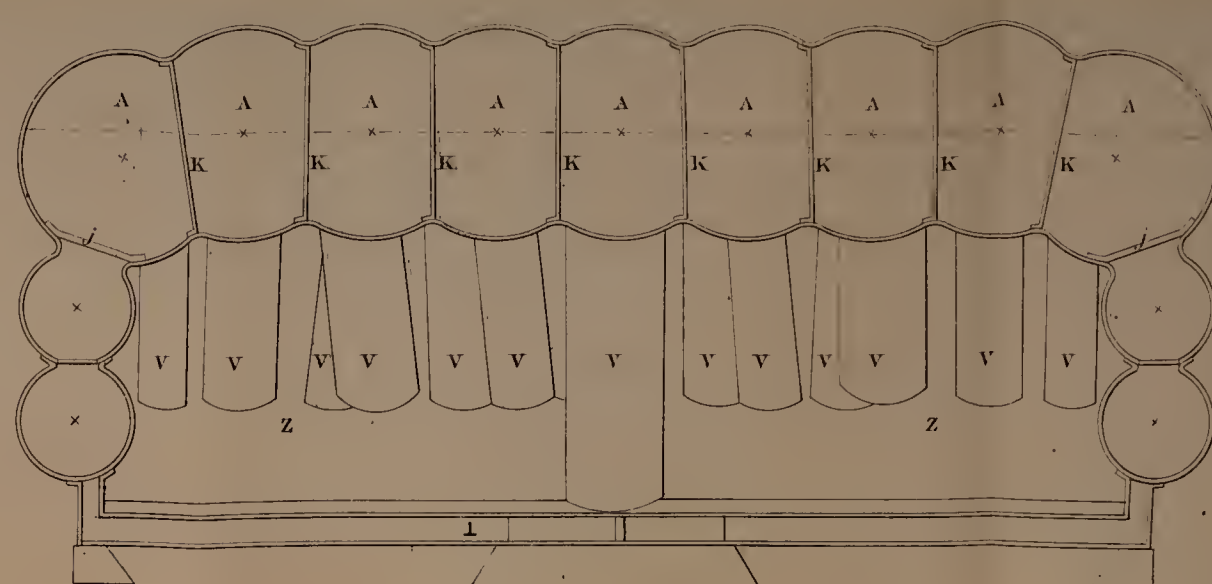


FIG. 15.

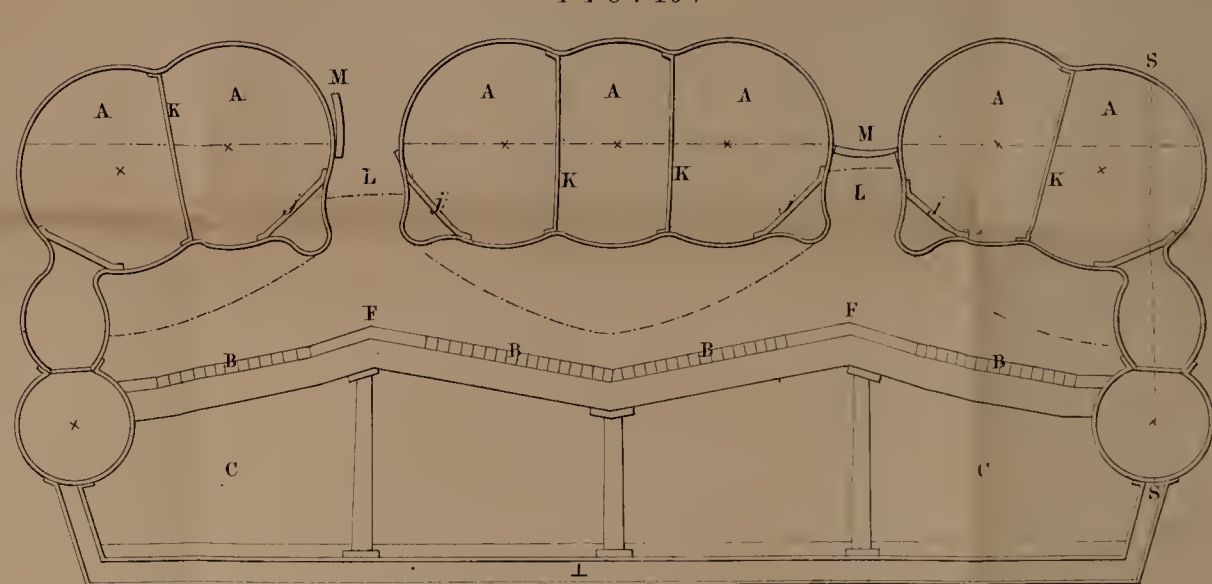


FIG. 11.

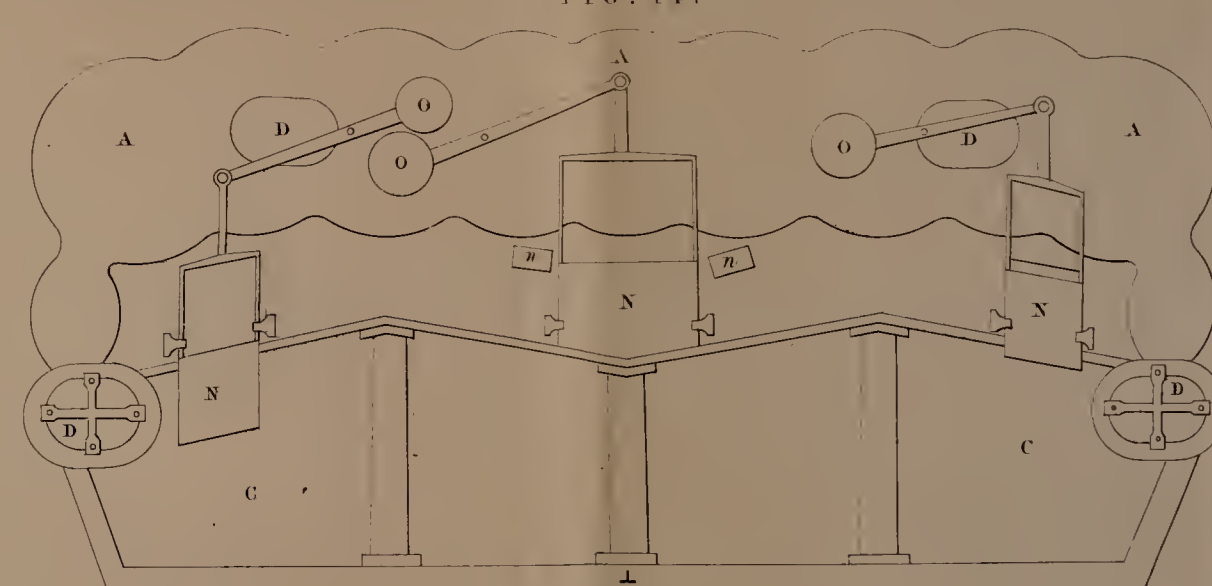


FIG. 16.

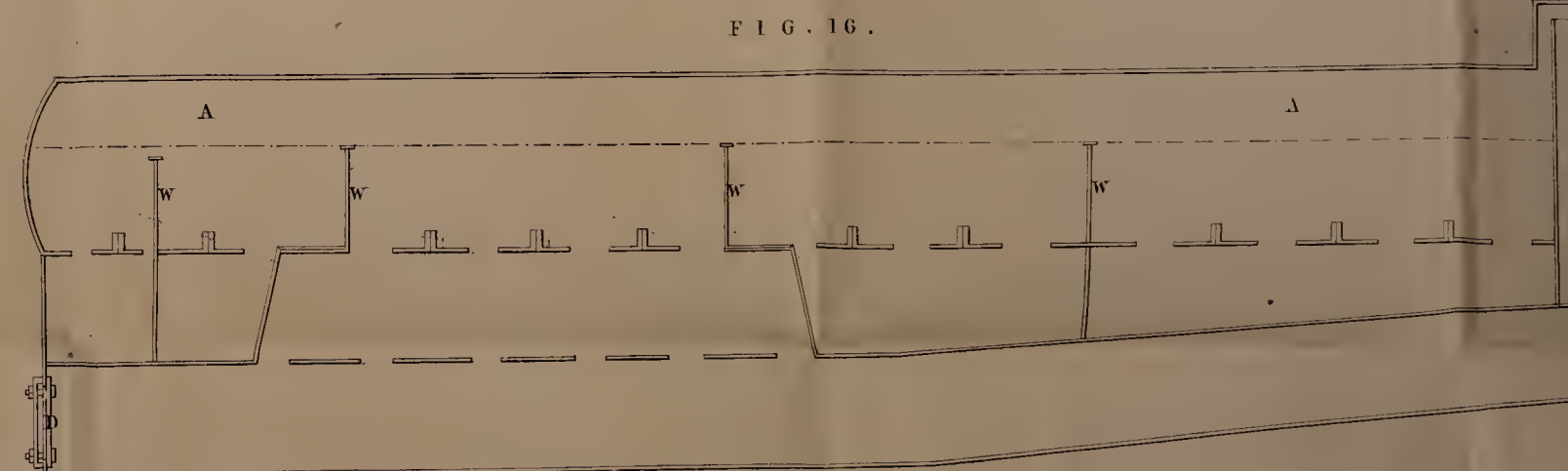


FIG. 17.

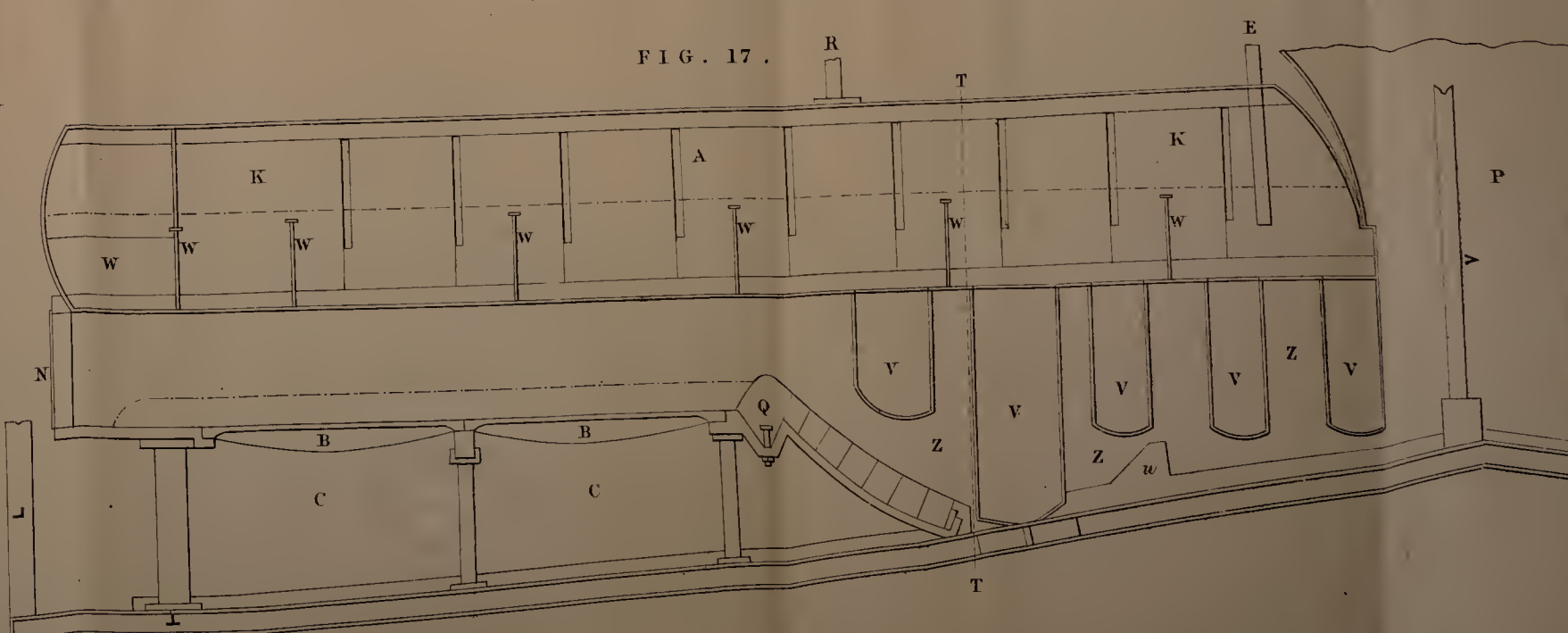


FIG. 12.

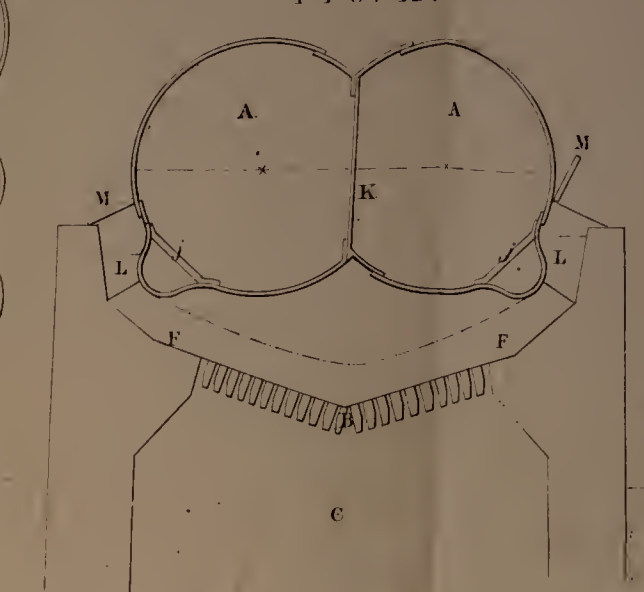
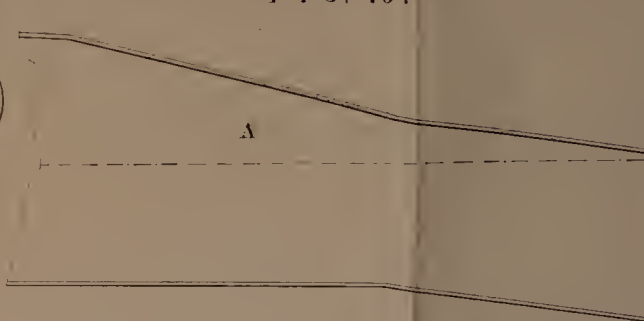



FIG. 13.





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they are combined with the coaking or roasting parts, but not otherwise, as herein described.

In witness whereof, I, the said Nathan Waddington, have hereunto set my hand and seal, this Twenty-third day of July, in the year of our Lord One thousand eight hundred and forty-one.

NATHAN (L.S.) WADDINGTON.

AND BE IT REMEMBERED, that on the Twenty-third day of July, in the year of our Lord 1841, the aforesaid Nathan Waddington came before our said Lady the Queen in Her Chancery, and acknowledged the Specification aforesaid, and all and everything therein contained and specified, in form above written. And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

WEBSTER, Extra.

Inrolled the Twenty-fourth day of July, in the year of our Lord One thousand eight hundred and forty-one.

LONDON:

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1854.

